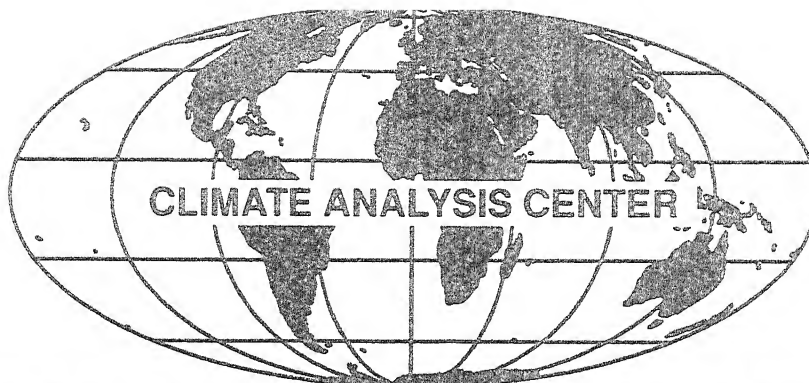


CONTAINS:

**UPDATE ON
THE INDIAN
MONSOON
AND AFRICAN
SAHEL RAINY
SEASON**

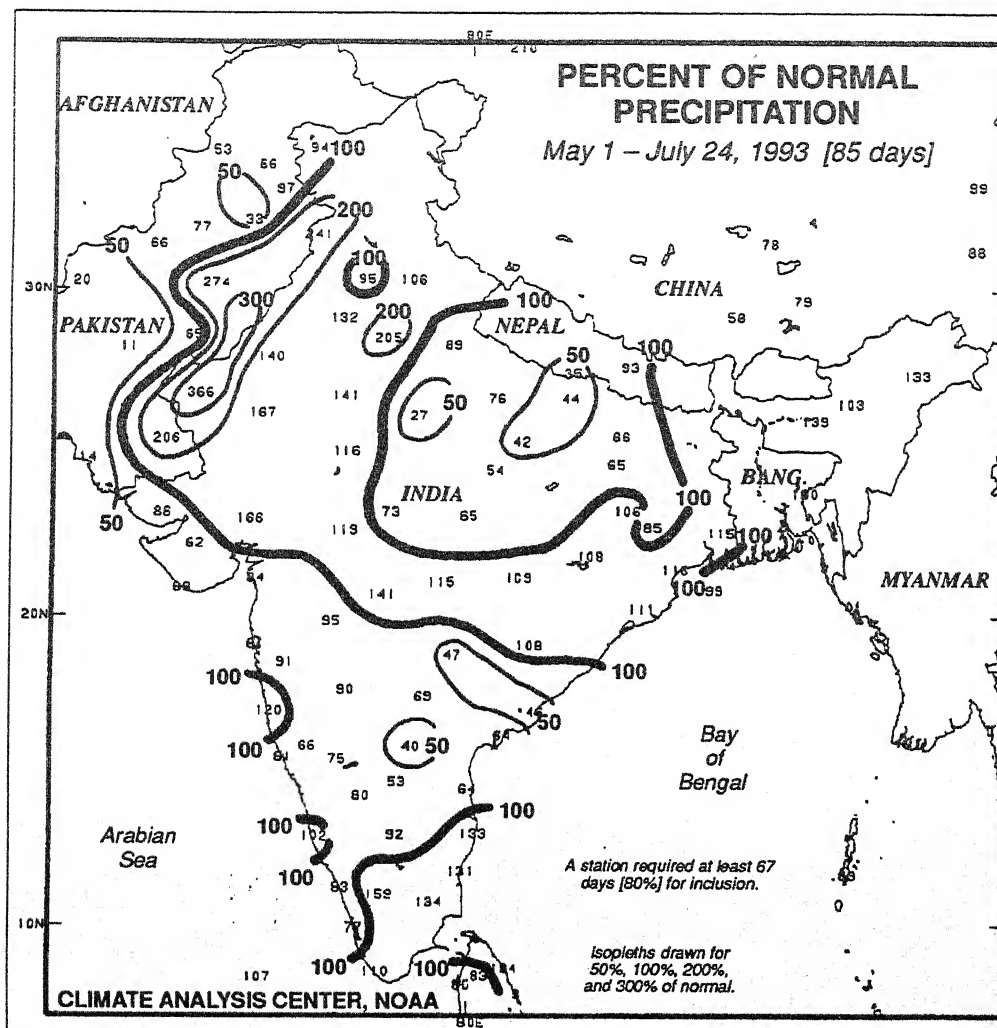


WEEKLY CLIMATE BULLETIN

No. 93/30

Washington, DC

July 28, 1993



HEAVY MONSOON RAINS CAUSE SEVERE FLOODING ACROSS LARGE SECTIONS OF INDIA, NEPAL, AND BANGLADESH, TAKING AT LEAST 4200 LIVES. *The 1993 monsoon arrived with a vengeance in much of northwestern India, eastern Pakistan, Nepal, Bangladesh, and extreme eastern India, dropping excessive rains on these regions during the last several weeks. According to press reports, weekly rainfall totals reaching 990 mm generated severe flooding that isolated the northeastern section of India from the remainder of the country. Farther south, heavy rains fell on already-swollen rivers, creating devastating floods across much of Bangladesh, especially near the Ganges, Brahmaputra, and Surma-Meghna River Valleys. Press reports indicate that over 600,000 acres were flooded, 500,000 homes were damaged, and some 20 million individuals (among a population of 110 million) were directly affected by the floods in Bangladesh alone, with six million people marooned in isolated villages. In Nepal, press reports indicated that flooding in the Katmandu Valley was the worst in 40 years, creating the country's worst disaster (in terms of property loss) in history [unfortunately, reliable meteorological data are lacking]. In central and western India, large tracts of farmland were flooded and some stored grain has been destroyed, but the country's tea output is expected to reach record levels. For more details on the southwest Asian monsoon and the African Sahel rainy season, refer to the Special Climate Summary on pp. 7 – 10).*



UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE–NATIONAL METEOROLOGICAL CENTER
CLIMATE ANALYSIS CENTER



WEEKLY CLIMATE BULLETIN

This Bulletin is issued weekly by the Climate Analysis Center and is designed to indicate, in a brief concise format, current surface climatic conditions in the United States and around the world. The Bulletin contains:

- Highlights of major climatic events and anomalies.
- U.S. climatic conditions for the previous week.
- U.S. apparent temperatures (summer) or wind chill (winter).
- Global two-week temperature anomalies.
- Global four-week precipitation anomalies.
- Global monthly temperature and precipitation anomalies.
- Global three-month precipitation anomalies (once a month).
- Global three-month temperature anomalies (once a month).
- Global twelve-month precipitation anomalies (every three months).
- Global twelve-month temperature anomalies (every three months).
- Special climate summaries, explanations, etc. (as appropriate).

Most analyses contained in this Bulletin are based on preliminary, unchecked data received at the Climate Analysis Center via the Global Telecommunications System. Similar analyses based on final, checked data are likely to differ to some extent from those presented here.

STAFF

Editor Richard J. Tinker
Associate Editor Paul Sabol
Contributors Robert H. Churchill
Andrew W. Clausen
Joseph A. Harrison
Thomas R. Heddinghaus
Alan Herman
Kevin P. Higgins

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GLOBAL CLIMATE HIGHLIGHTS

MAJOR CLIMATIC EVENTS AND ANOMALIES AS OF JULY 24, 1993

1. Northwestern United States and Southwestern Canada:

COOL CONDITIONS CONTINUE.

Temperatures averaged 3°C to 6°C below normal, with the greatest negative departures reported in Utah and Wyoming [4 weeks].

2. North-Central United States and South-Central Canada:

ABNORMALLY WET WEATHER PERSISTS.

Precipitation totals above 50 mm were widespread across the region while torrential downpours dumped as much as 290 mm on Nebraska and 230 mm on Kansas. Six-week moisture surpluses reached 490 mm at some locations as severe river flooding continued to plague the region [23 weeks].

3. Eastern United States:

MODERATE RAINS REPORTED.

Up to 50 mm of rain fell on the eastern Carolinas, bringing limited relief. To the north and west, however, amounts were below 30 mm as six-week moisture shortages reached 150 mm at several locations [13 weeks].

4. Mexico:

WET WEATHER EASES.

Although as much as 90 mm of rain fell on a few locations, most areas received less than 50 mm as conditions began to improve [5 weeks].

5. Southern Africa:

UNUSUALLY WARM CONDITIONS DEVELOP.

Temperatures averaged up to 5°C above normal as abnormally warm weather covered the region [3 weeks].

6. Northern India:

HEAVY MONSOON RAINS CONTINUE.

Widespread heavy rains in excess of 100 mm caused flooding in parts of the region. Totals of up to 440 mm were reported as six-week moisture excesses approached 330 mm at some locations (see Special Climate Summary, pages 7-10) [6 weeks].

7. Southeastern China:

MORE HEAVY SHOWERS REPORTED.

After a brief respite, another wet week was reported. Over 170 mm of rain fell on some locations while accumulated six-week moisture surpluses reached up to 420 mm [15 weeks].

8. Korea, Japan, and Northeastern China:

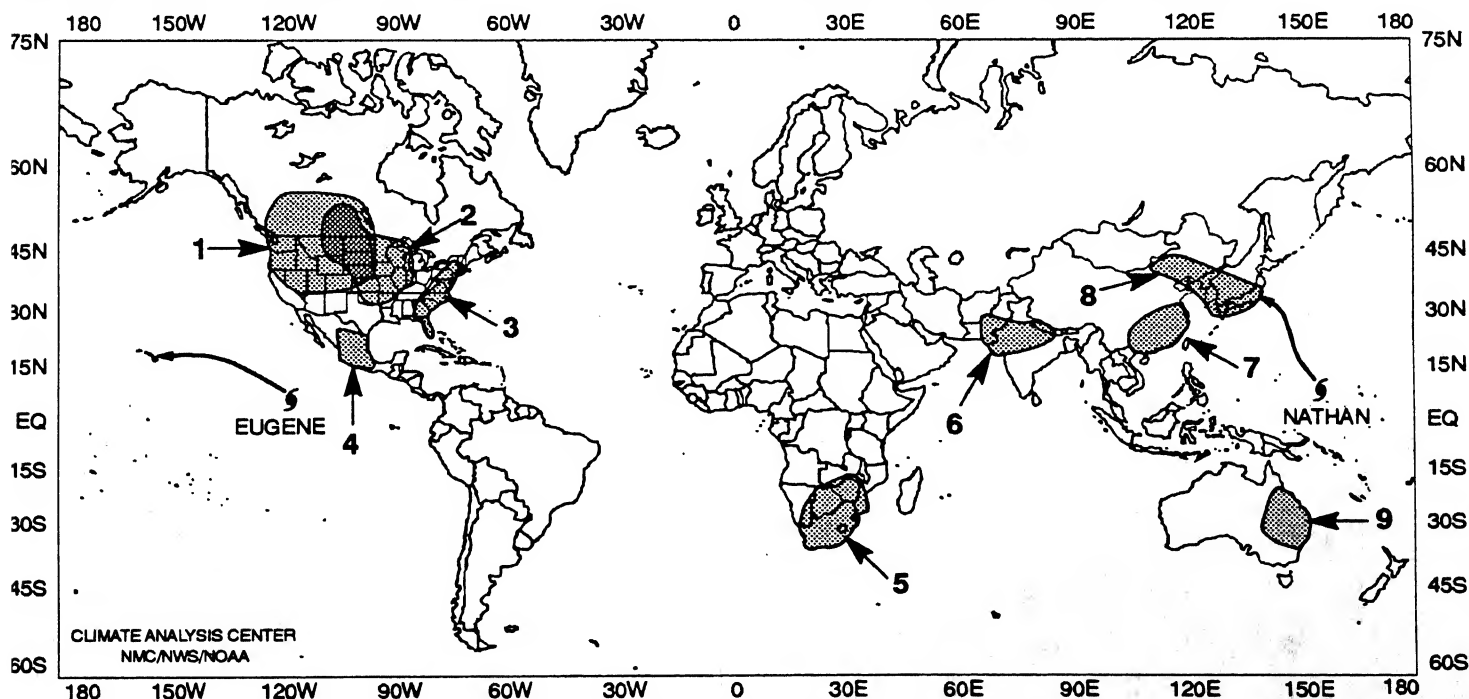
TORRENTIAL RAINS AGAIN SOAK REGION.

Northeastern China received as much as 150 mm of rain while Korea reported up to 310 mm. Farther east, heavy rains from Typhoon Nathan inundated Japan with up to 355 mm and sent six-week precipitation excesses soaring to 940 mm at a few locations on Kyushu [14 weeks].

9. Eastern Australia:

UNUSUALLY WARM WEATHER DEVELOPS.

Temperatures averaged 3°C to 6°C above normal as abnormally high temperatures spread across much of northern New South Wales and southern Queensland [3 weeks].

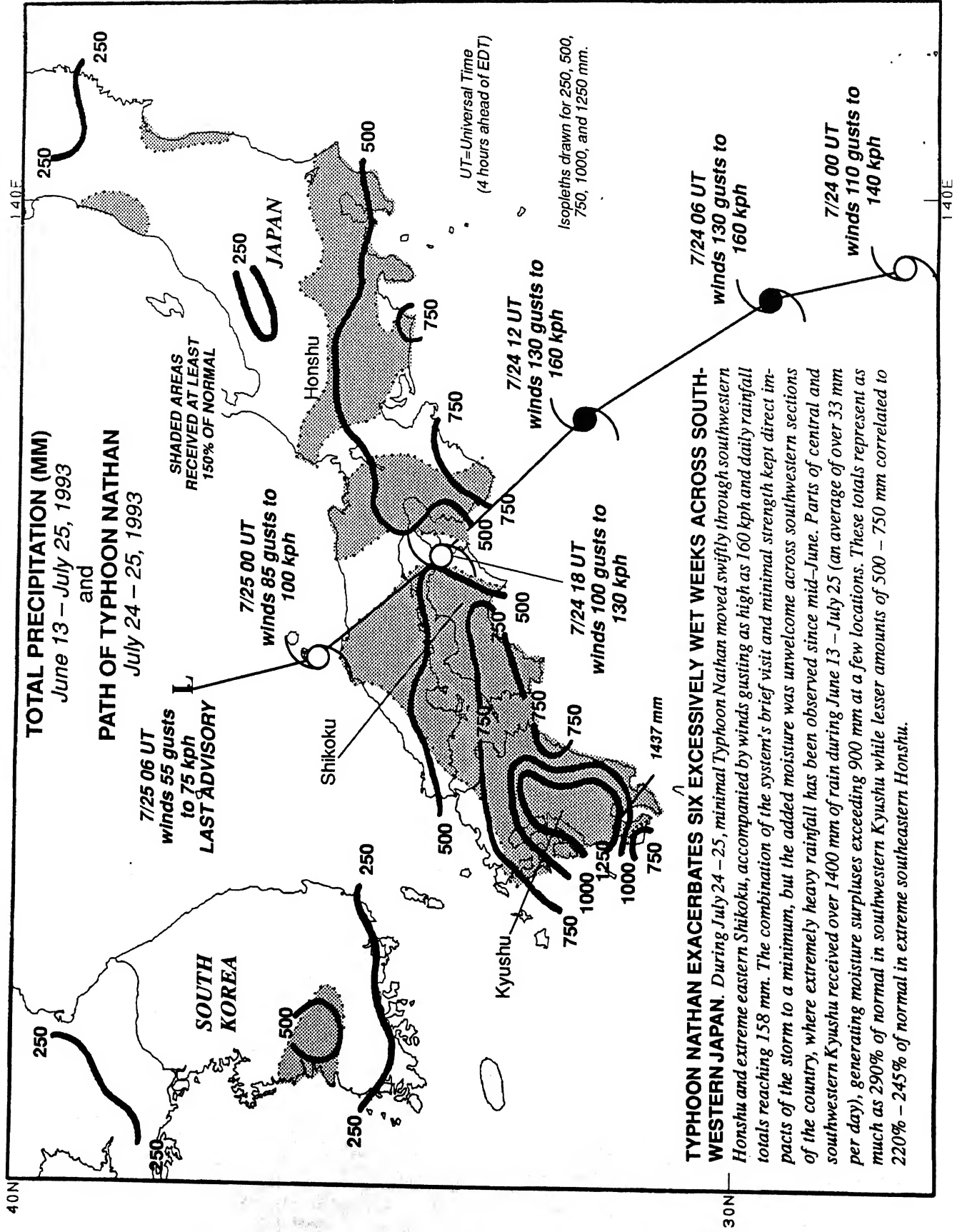


EXPLANATION

TEXT: Approximate duration of anomalies is in brackets. Precipitation amounts and temperature departures are this week's values.

MAP: Approximate locations of major anomalies and episodic events are shown. See other maps in this Bulletin for current two week temperature anomalies, four week precipitation anomalies, long-term anomalies, and other details.

GLOBAL CLIMATE HIGHLIGHTS FEATURE



TYPHOON NATHAN EXACERBATES SIX EXCESSIVELY WET WEEKS ACROSS SOUTHWESTERN JAPAN. During July 24 – 25, minimal Typhoon Nathan moved swiftly through southwestern Honshu and extreme eastern Shikoku, accompanied by winds gusting as high as 160 kph and daily rainfall totals reaching 158 mm. The combination of the system's brief visit and minimal strength kept direct impacts of the storm to a minimum, but the added moisture was unwelcome across southwestern sections of the country, where extremely heavy rainfall has been observed since mid-June. Parts of central and southwestern Kyushu received over 1400 mm of rain during June 13 – July 25 (an average of over 33 mm per day), generating moisture surpluses exceeding 900 mm at a few locations. These totals represent as much as 290% of normal in southwestern Kyushu while lesser amounts of 500 – 750 mm correlated to 220% – 245% of normal in extreme southeastern Honshu.

UNITED STATES WEEKLY CLIMATE HIGHLIGHTS

FOR THE WEEK OF JULY 18 – 24, 1993

Persistent heavy rains continued to deluge the northern and central Plains and middle Mississippi Valley, pushing rivers and streams to heights higher than the record levels of the previous few weeks. According to press reports, crop and property damage is now estimated at up to \$12 billion in the Midwest, with 41 flood-related deaths, 31,200 homes ruined, tens of thousands of people displaced, and about 10.2 million acres under water. Nearly twelve inches of rain fell in parts of the middle Missouri Valley (including seven inches in five hours at Nebraska City, NE) while up to nine inches inundated the northern middle Mississippi Valley, increasing the flows of both the Missouri and Mississippi Rivers and their tributaries. It is now expected that a crest of 48 feet will be reached at St. Louis, MO, 18 feet above flood stage and a foot higher than last week's record 47-foot crest. The 55-mile-long Sny Island levee was breached about ten miles south of Quincy, IL. Resulting flooding covered 44,000 acres of farmland and a ten-mile section of the Central Illinois Expressway. The levee was one of the last agricultural levees still intact along the 300-mile stretch of the Mississippi between St. Louis and Davenport, IA. Residents were also evacuated from towns south of St. Louis where more levees broke, including one which had protected the 15,000-acre Kaskaskia Island, IL. As Des Moines, IA, restored its running water system, levees surrounding water plants in Alton, IL and St. Joseph and Weston, MO gave way, leaving another 157,000 people without drinking water. Pattonsburg, MO, on the Grand River, was evacuated for the second time this month while the Big Nemaha River rose from 12 feet to 25 feet at Falls City, NE. According to the Army Corps of Engineers, nearly 75% of the non-Federal levees throughout the flooded region have been over topped or breached by swollen rivers. Torrential rains (four and a half inches in three hours at Glen Ullin) also caused flooding across southwestern North Dakota.

In contrast, hot weather continued across the drought-plagued Southern Atlantic Coast States, with temperatures averaging 4°F to 8°F above normal. Scattered heavy rains, however, of up to five and half inches brought some relief to parts of Virginia, the Carolinas, and Georgia.

The week commenced with strong thunderstorms generating heavy rain near a front reaching from the central Plains to a low pressure system centered over the Great Lakes. Heavy amounts fell on eastern Kansas, pouring more water into the swollen Missouri River, while torrential downpours saturated parts of southern Wisconsin, northern Illinois, and southern Michigan. Showers and thunderstorms were also scattered from the northern Rockies to the upper Mississippi Valley and across the Ohio Valley and Deep South. A half dozen-daily high

temperature records were set in the hot muggy, air across the Southeast while cool weather continued in the Northwest, northern Rockies, and Great Basin where a few new daily low temperature records were established in Idaho, Montana, and Nevada. By mid-week, the low pressure system moved eastward into the Atlantic, scattering rain across the eastern third of the nation. Meanwhile, showers and thunderstorms continued to inundate the central Plains and middle Mississippi Valley along a stationary front. Locally heavy amounts also drenched portions of the southern High Plains and central Gulf Coast.

During the latter part of the week, showers and thunderstorms persisted over the central Plains and middle Mississippi Valley, aggravating the severe flooding along the middle and lower Missouri River and the middle half of the Mississippi. Cool, wet weather remained from the northern Pacific coast to the northern Plains while heat, humidity, and scattered thunderstorms dominated the lower Mississippi Valley and Southeast. Record highs continued to be established daily over parts of the southern Atlantic Coast States.

According to the River Forecast Centers, the greatest weekly totals (from two to nearly twelve inches) fell on the central and northern Great Plains, the middle Mississippi Valley, and the central Gulf Coast. Amounts of more than two inches were also scattered over the mid-Atlantic, the Northeast, the Southeast, the Great Lakes, the Ohio Valley, the lower Mississippi Valley, the southern High Plains, the Pacific Northwest, southern Alaska, and the Big Island of Hawaii, with over ten inches of rain inundating the latter region. Light to moderate rainfall was recorded across the Rockies and the remainders of the Northwest, the southern High Plains, southern Alaska, Hawaii, and the eastern third of the nation. Little or no precipitation fell on the southeastern Plains, the desert Southwest, California, the Great Basin, and the remainder of Alaska.

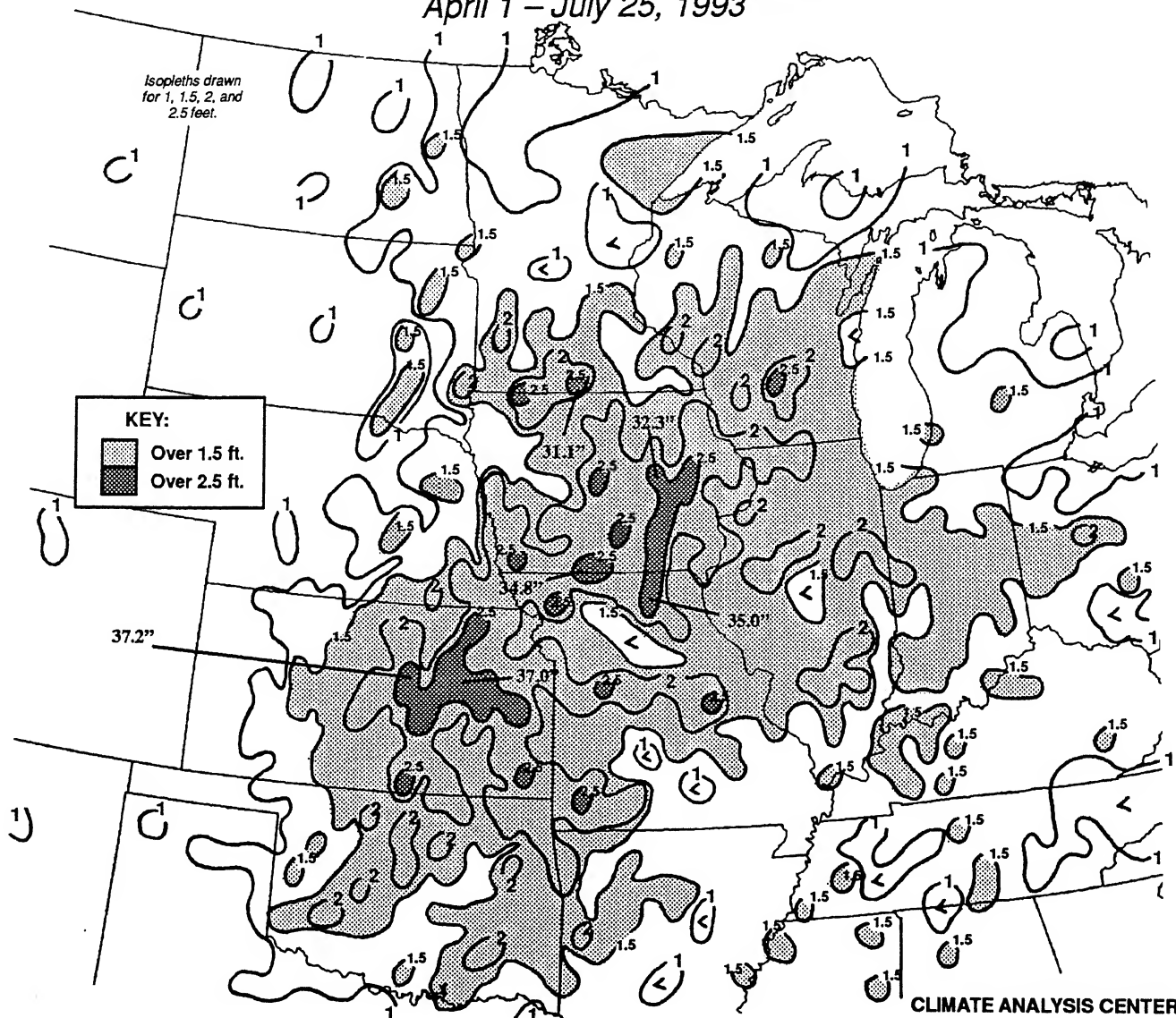
In the contiguous United States, above normal temperatures covered the area from southeastern Plains eastward to the middle and southern Atlantic Coast, with weekly departures of +3°F to +8°F observed from eastern Oklahoma eastward to the coasts of Georgia and the Carolinas. Abnormally warm conditions persisted in Alaska, with departures reaching +14°F at Nome. Temperatures averaged near to slightly above normal in Hawaii.

Abnormally cool conditions prevailed over much of the remainder of the country, with departures from -6°F to -12°F observed from interior southern California and the desert Southwest northward to the interior Northwest, northern Rockies, and northern High Plains. Lows dipped into the thirties in portions of the northern Rockies.

UNITED STATES CLIMATE HIGHLIGHTS FEATURE

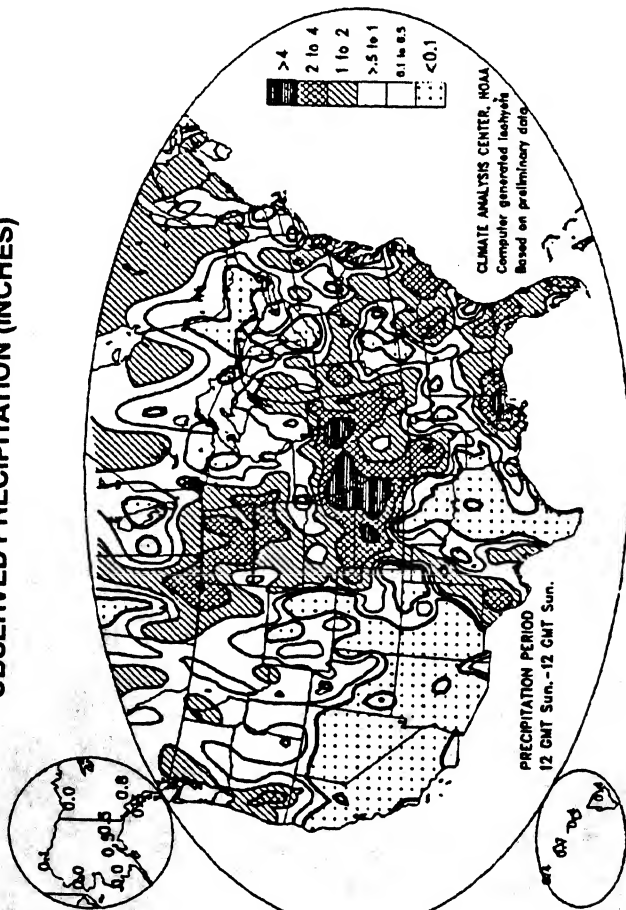
TOTAL PRECIPITATION (FEET)

April 1 – July 25, 1993

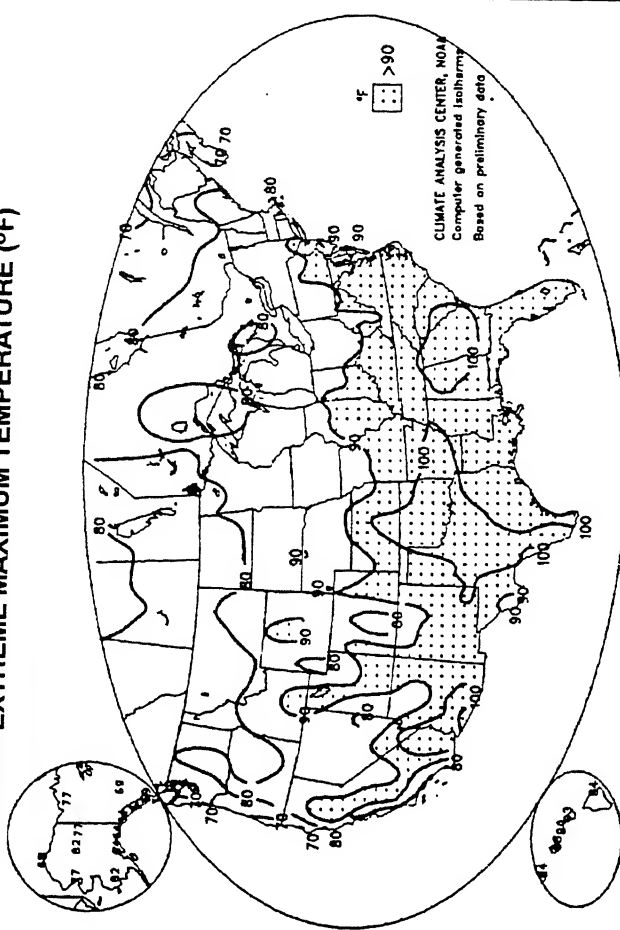
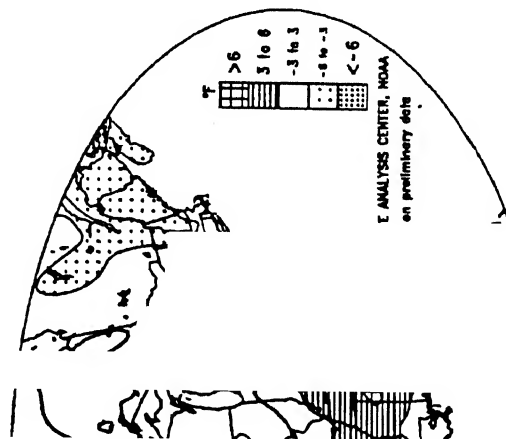


OVER THREE FEET OF PRECIPITATION FALLS ON PARTS OF THE GREAT PLAINS AND MISSISSIPPI VALLEY IN LESS THAN FOUR MONTHS, GENERATING SEVERE RIVER FLOODING ACROSS MUCH OF THE MISSISSIPPI RIVER DRAINAGE BASIN. Wetter than normal long-term moisture budgets date back to late July 1992 through portions of the northern Great Plains and upper Mississippi Valley. Since the beginning of this growing season (April 1, 1993), exceptionally heavy rains have exacerbated the long-term surpluses, creating severe and, in some instances, devastating river flooding across the upper and middle Mississippi Valley and along many of the river's tributaries, including the Missouri River (for a more detailed description of the region's flood-related impacts, please refer to the special updates published in Weekly Climate Bulletin issues 93/27 (dated July 7, 1993) and 93/29 (dated July 21, 1993)). Totals exceeding 1 1/2 feet fell on a large section of the upper Midwest, western Great Lakes, Corn Belt, and eastern Great Plains, with amounts approaching or slightly exceeding three feet in parts of east-central Kansas, northern Missouri, eastern Iowa, and extreme southern Minnesota. Last week's highest rainfall totals (between four and 11.5 inches) were measured across southeastern Nebraska, northern Kansas, northern Missouri, and the southern half of Iowa. These new rains have caused the Army Corps of Engineers to raise the forecast crest at St. Louis, MO to 48 feet on August 3, just four feet below the top of the city's primary levee, while the Kansas River in Kansas City, MO is expected to crest near the top of its levee at a record 54.9 feet. Several other levees failed or began to leak during the week, flooding water treatment plants and leaving over 150,000 individuals without potable tap water in Alton, IL and St. Joseph, MO. Running water was restored to the 250,000 who had lost the service in Des Moines, IA, but the water is still unfit for ingestion straight from the tap.

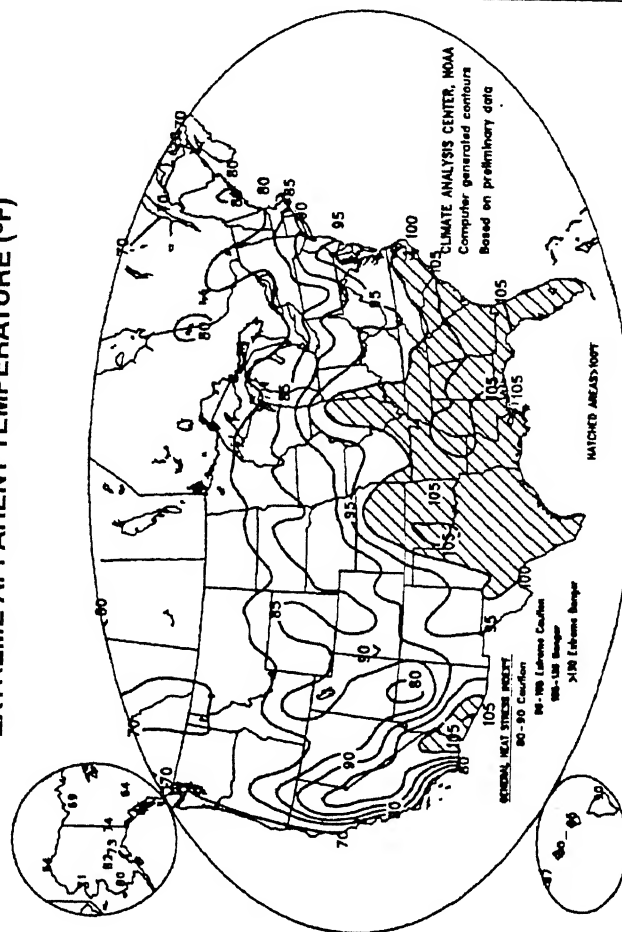
OBSERVED PRECIPITATION (INCHES)



EXTREME MAXIMUM TEMPERATURE (°F)

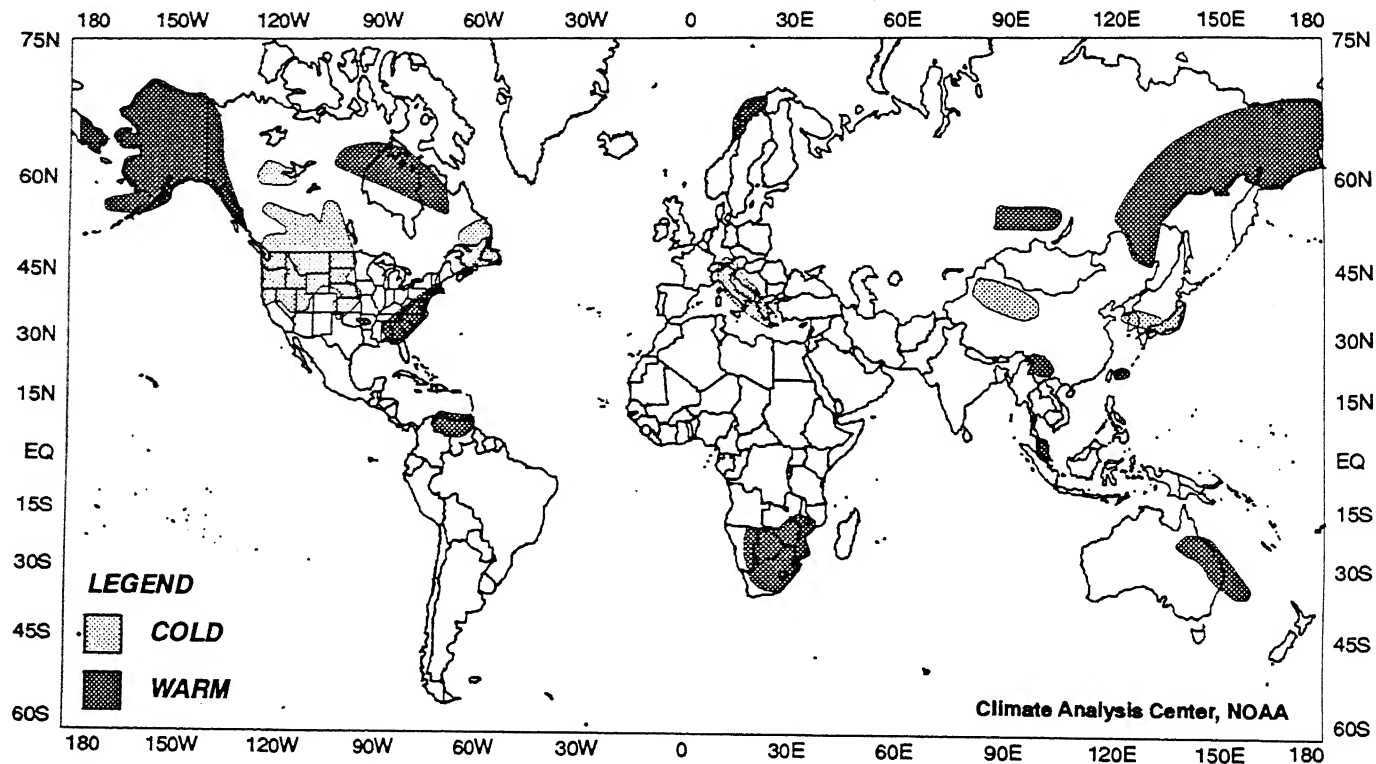
DEPARTURE OF AVERAGE TEMPERATURE
FROM NORMAL (°F)

EXTREME APPARENT TEMPERATURE (°F)



2-WEEK GLOBAL TEMPERATURE ANOMALIES

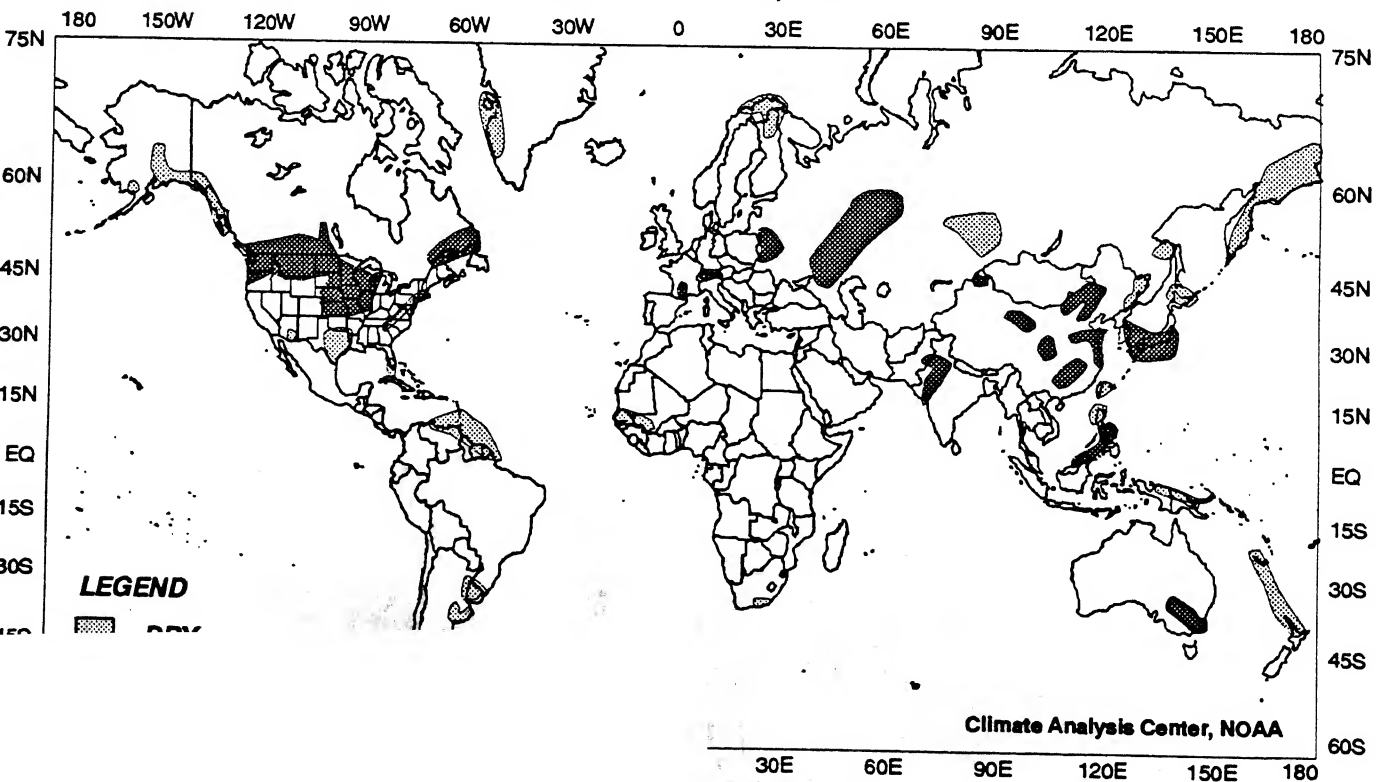
JULY 11 – 24, 1993



Shading depicts regions where temperature anomalies were estimated to be within the warmest 10% or coldest 10% of climatological occurrences.

4-WEEK GLOBAL PRECIPITATION ANOMALIES

JUNE 27 – JULY 24, 1993



Shading depicts regions where precipitation anomalies were estimated to be within the wettest 10% or driest 10% of climatological occurrences.

SPECIAL CLIMATE SUMMARY

*ANALYSIS AND INFORMATION BRANCH
CLIMATE ANALYSIS CENTER, NMC
NATIONAL WEATHER SERVICE, NOAA*

UPDATE ON THE INDIAN MONSOON AND AFRICAN SAHEL RAINY SEASON

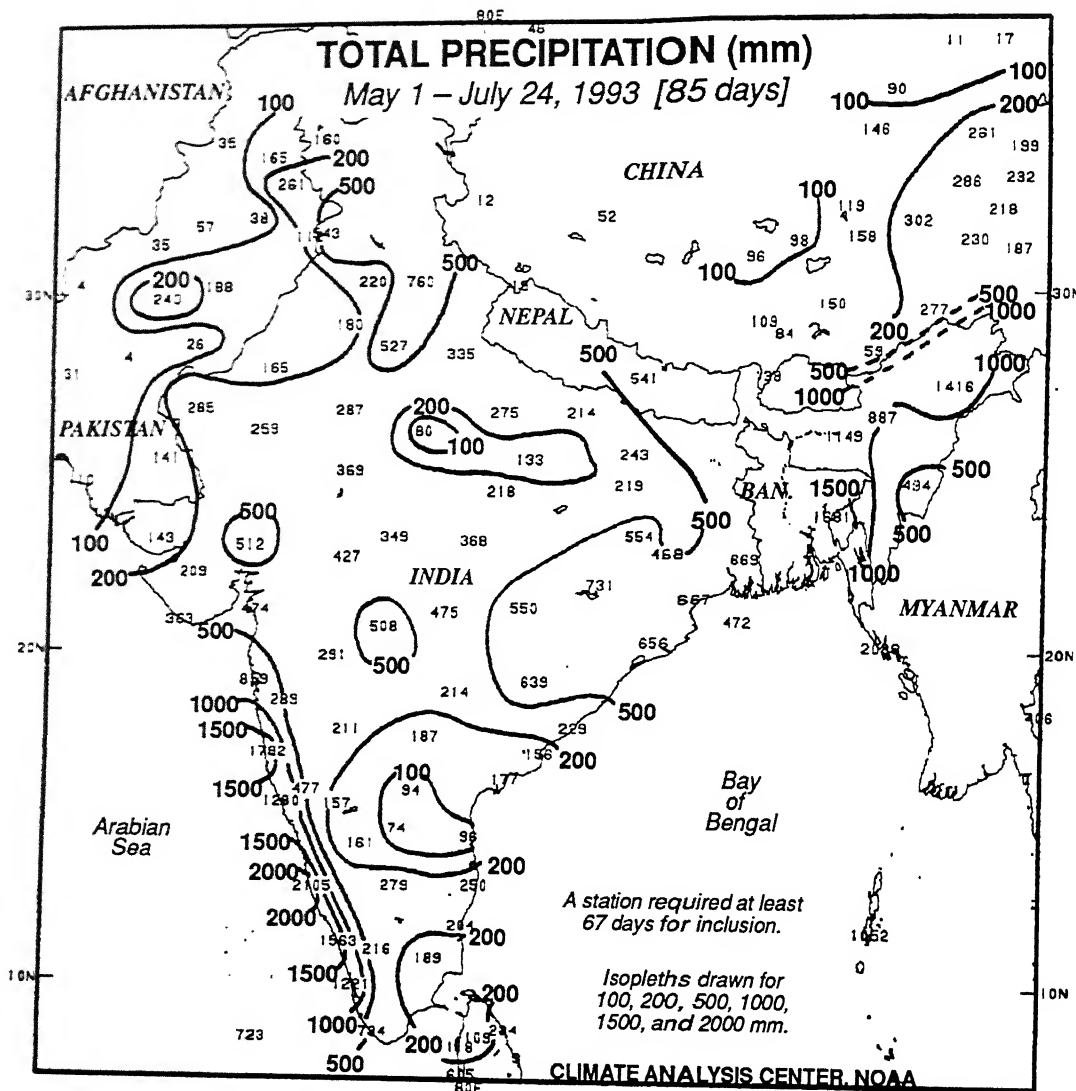
Rain typically falls in a very distinct pattern across the Indian Subcontinent and the African Sahel. In both regions, rains near the equator normally spread northward during the last half of spring and early summer, reaching a maximum northward extent (and, in the case of the Indian Subcontinent, northwestward extent) during August before retreating back toward the equator during late summer and early autumn (for a graphical depiction of the normal advance of the southwest Asian monsoon, see the bottom of page 8). Across the Indian subcontinent, the heaviest totals are normally observed along the western coastline of India south of Gujarat and across Bangladesh and northeastern India. Through sub-Saharan Africa, rainfall generally decreases from south to north, except for the large amounts typically recorded through the Ethiopian highlands. Furthermore, the percent of the normal annual rain that typically falls during May – September generally increases from south to north through sub-Saharan Africa and from southeast to northwest through India. To this effect, more than 90% of normal annual precipitation typically falls during the 5-month May – September period across the central tier of India, along most of the western Indian coastline, through most of the western half of the Sahel north of 12°N (except northwestern Senegal), and across the eastern half of the Sahel north of 10°N, except in Ethiopia.

Monsoonal rains generally began on schedule and in abundance across the Indian Subcontinent, although subnormal rains have been observed recently through north-central India and across portions of south-central and southeastern India (see front cover). Rainfall has been persistent and excessively heavy through portions of eastern Pakistan, northwestern India, Nepal, Bangladesh, and extreme northeastern India, where many locations reported between 130% and 370% of normal during May 1 – July 24. Most of northwestern and north-central India and eastern Pakistan reported 140 – 515 mm of rain, most of which fell during the last three weeks (see page 8). Recently, the Sutlej River spilled out of its banks, flooding adjacent areas and threatening to inundate some agriculturally-critical sections of Punjab. Portions of Nepal and northern India received 500 – 760 mm while the western India coastline (where normals are quite high) reported totals of 860 – 2105 mm. Weekly totals in excess of 100 mm were observed in five of the last six weeks at a few locations in southwestern India. Farther east, only 80–300 mm fell on portions of north-central India and adjacent sections of Nepal, where the monsoon got off to a quick start but has recently subsided. Across northern and eastern Nepal, Bangladesh, and extreme eastern India, conditions were similar to those across the western tier of the subcontinent, with abnormally heavy rains reported

since the start of the monsoon causing severe river and lowland flooding. Between 1150 and 1680 mm of rain had officially fallen on parts of extreme eastern India since May 1, with unofficial reports indicating weekly totals of up to 990 mm measured at a few locations. Press reports indicate that floods generated at least twenty million (U.S.) dollars in damage across Nepal, and that the death toll in that country alone may reach 3,000. In Bangladesh, over 2500 km of roads were damaged and more than 17,000 head of cattle were killed, according to press reports.

The rainy season to date has been far less eventful across the African Sahel. Through the western half of sub-Saharan Africa, a quick start to the wet season has been followed by generally below normal precipitation. Only parts of south-central Senegal, southern Mauritania, southwestern Mali, central Burkina Faso, and southwestern Niger received above normal amounts, with 120% – 205% of normal reported at isolated locations in southern Senegal, southern Mauritania, central Mali, southeastern and northwestern Burkina Faso, and southwestern Niger. In addition, portions of Cameroon, where rainfall is more evenly distributed throughout the year, received well above normal amounts (page 9). Rainfall totals varied widely through the region, ranging from under two millimeters in northwestern Senegal and southwestern Mali to 500 – 1165 mm in western Guinea, southern Cote d'Ivoire, central Ghana, northern Togo, and parts of Cameroon (page 10). Shortly after the period depicted on pages 9 and 10, however, torrential rains and resultant flooding cut rail traffic between Senegal and Mali and stranded the Dakar–Bambako express train about halfway between Dakar, Senegal and the Senegal/Mali border, according to press reports. Despite these events and heavy rains early in the season, most of the western half of the Sahel has received below normal rainfall, particularly since mid-June.

A similar situation has been observed across the eastern Sahel, although heavier rains early in the period have pushed season-to-date totals relatively high, especially across Ethiopia and northern Kenya (see pages 9 and 10). Following a quick start, rains have tapered off dramatically, particularly through the last five weeks. Rainfall across most locations has been below normal as the Inter-Tropical Convergence Zone has been south of its normal position for each of the past five weeks. During June 1 – July 20, the average Inter-Tropical Convergence Zone position was south of its normal location, especially through the western half of the Sahel. One exception to the dryness that has covered the eastern Sahel, however, has been the Central African Republic, where heavy rains caused flooding that left 2600 individuals homeless last week.



MEAN DATES OF THE SOUTHWEST MONSOON'S ARRIVAL

